Space Weather Technical Forecast

Issued on Wednesday, 08 June 2022 at 01:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of a glancing blow from a weak CME early on 08 June, but low confidence. Otherwise, no significant activity. Slight chance of Active fluence later.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Very Low over the past 24 hours, with just B-class flares during the period. There are now no sunspot regions on the visible disc, although there appears to be a potential new region rotating onto the southeast limb, with a further potential new region nearing the northeast limb. It is too early as yet to assess either of these regions.
Two CMEs were observed travelling northwards on coronagraph imagery, but neither of these are considered likely to have an Earth directed component. No other CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, shows largely background conditions with weak CME effects gradually waning. Wind speeds have been at ambient levels, between 300-340km/s. Density has been average or above average, with a peak of 19ppcc around 07/0355 UTC. The Interplanetary Magnetic Field, Bt, started at moderate levels around 9nT, but gradually eased to weak. The north-south component, Bz, ranged between +2/-7nT, and has been predominantly southward directed. The phi angle was mostly negative (towards the Sun) at first, but became more variable after 07/1000 UTC. Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels.
Electron flux was at predominantly background levels. Electron fluence was below the Active (1e8 integrated pfu) threshold on a downward trend, with 2.14e6 integrated pfu recorded at 08/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be Very Low initially. Returning active regions may increase the risk of flares through the period, although the degree to which this occurs is uncertain until these regions can be seen on the visible disc.

Solar Wind / Geomagnetic Activity: The solar wind is currently at background levels after the recent weak CME. There is a slight chance of a further CME arriving early on Day 1 (08 June), which left the Sun on 04 June. There is low confidence in this aspect of the forecast, and this CME is most likely to miss Earth. There are also two non-persistent small and weak coronal holes that could give faster winds to around 450 km/s during the forecast period, with CH87 likely on Day 3 (10 June) and CH88 on Day 4 (11 June). The proximity of the Solstice means that any geomagnetic response from coronal holes at this time of year is likely to be muted.
As such, geomagnetic activity is expected to be mostly Quiet through this period. However, there is a risk of Unsettled to Active (Kp3-4) intervals early on Day 1 in the event of the CME arrival, and again on Days 3 and 4 if we see any high speed stream effects from CH87 or 88.

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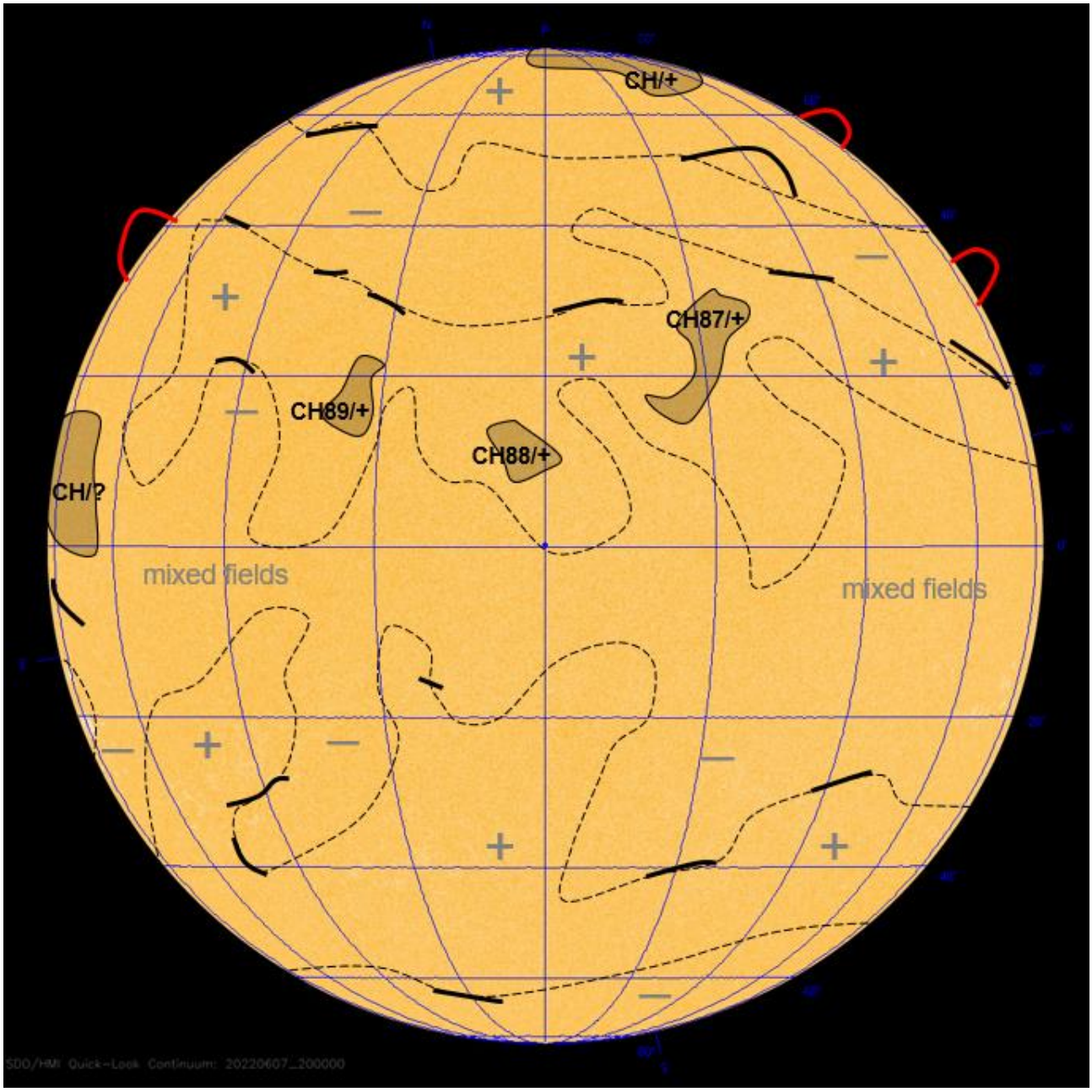
Met Office Space Weather Technical Forecast

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at Background levels during this period.
High energy electron flux (greater than 2MeV) is expected to vary between Normal Background and perhaps Moderate levels. Electron fluence is expected to remain below the Active threshold throughout, although with just a slight chance of a recovery in fluence levels.

Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The solar wind is currently at background levels after the recent weak CME. There is a slight chance of a further CME arriving early on Day 1 (08 June), from a filament eruption which left the northeast quadrant on 04 June. There is low confidence in this aspect of the forecast, and this CME is most likely to miss Earth.

There are also two non-persistent small and weak coronal holes (CH87/+ and CH88/+) that could give weak high speed streams during the forecast period, with CH87 likely on Day 3 (10 June) and CH88 on Day 4 (11 June). However, both are very small and unlikely to have a significant effect with wind speeds not expected to reach much above 450 km/s. In addition, the proximity of the Solstice means that any geomagnetic response from coronal holes at this time of year is likely to be muted. STEREO-A MAG and PLASTIC data appears not to have updated since approximately 06/1230 UTC, and as such is not currently providing helpful guidance.

As such, geomagnetic activity is expected to be mostly Quiet through this period. However, there is a risk of Unsettled to Active (Kp3-4) intervals early on Day 1 in the event of the CME arrival, and again on Days 3 and 4 if we see any high speed stream effects from CH87 or 88.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	2	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
04/1032	Partial	Filament	32N 30E	620 km/s	Early 08 June	Possible glancing blow. Most likely missing.

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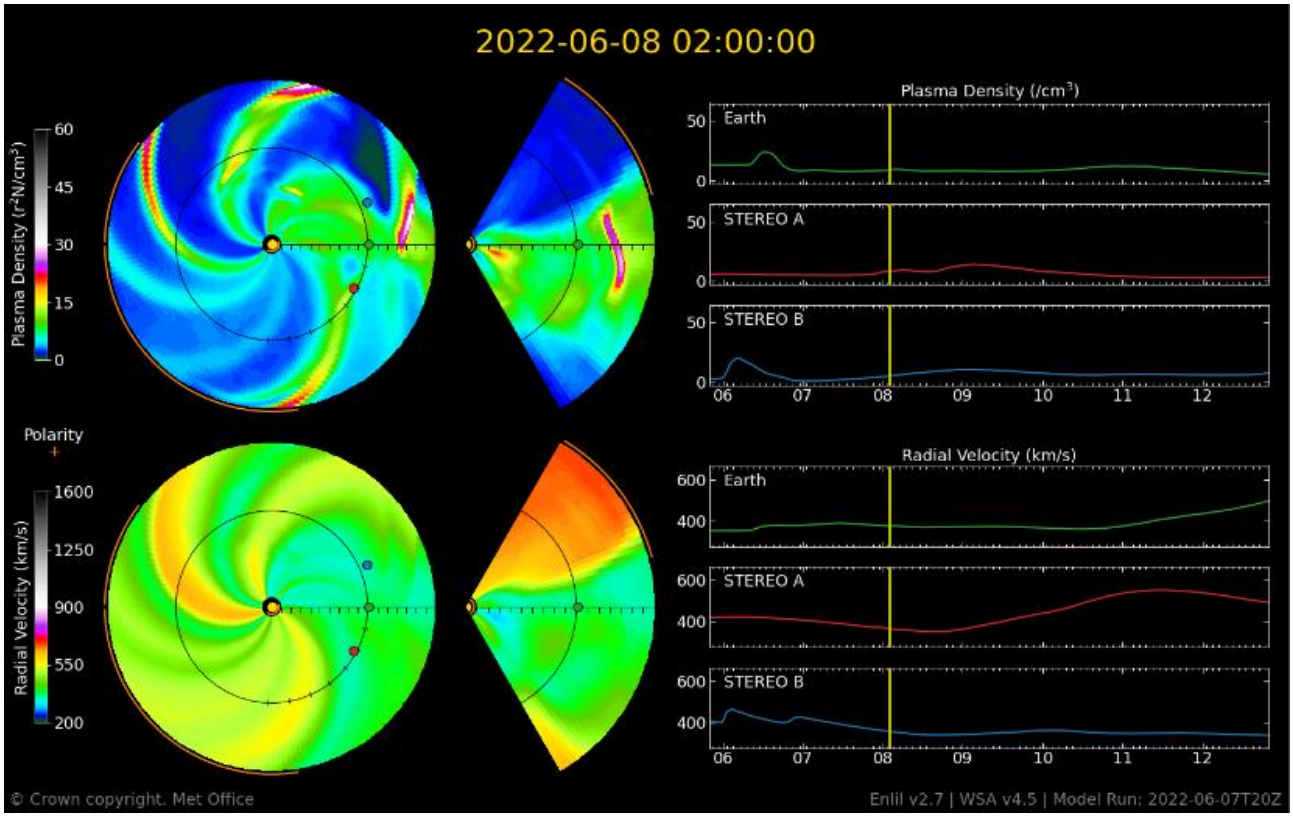
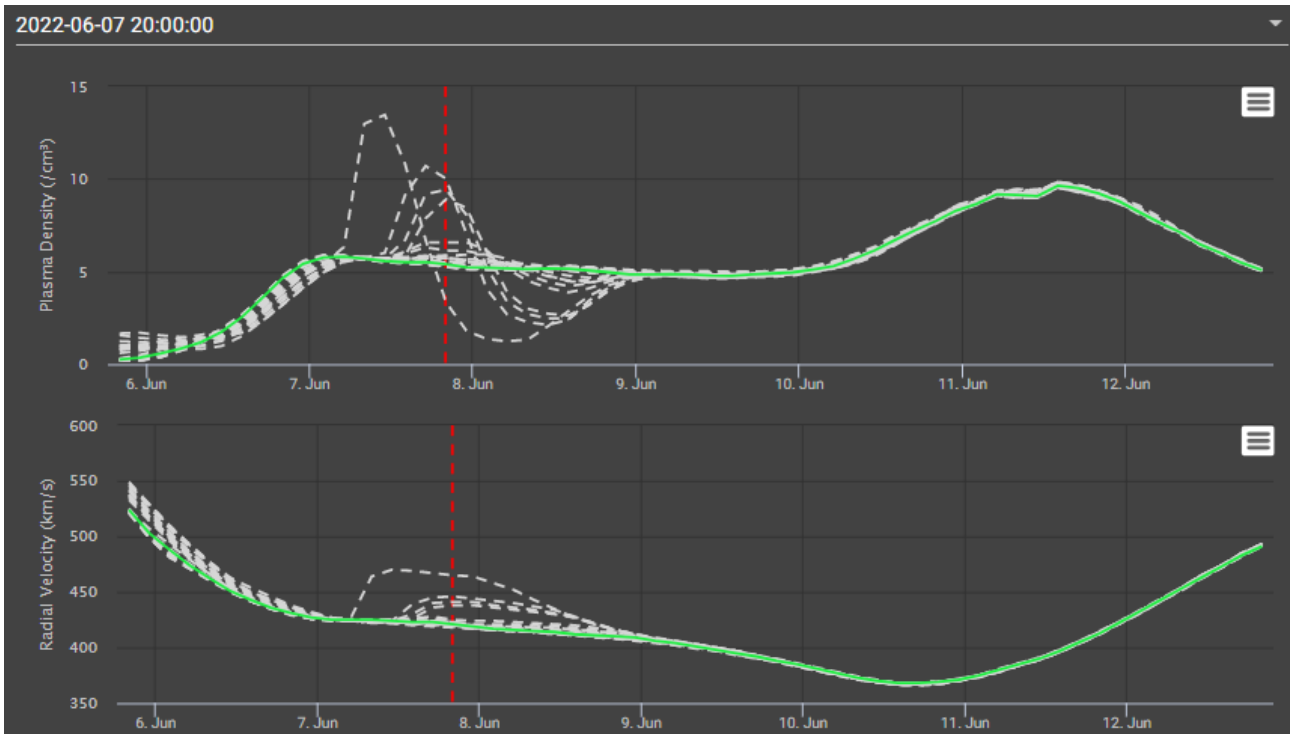
Figure 2: Enlil and ensemble showing a very low risk of a glancing CME blow early on 08 June.





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Radio Blackouts - X-Ray Flares:

There are now no sunspots on the visible disc. However, STEREO-A EUVI-195 imagery does hint at possible returning region(s) near the east limb, with the first of these possibly in the process of rotating onto the southeast limb. This is the rationale for the slight uptick in the risk of M-class flares in the forecast period, although this is effectively a placeholder as any returning region(s) cannot be analysed until they become fully visible after rotating onto the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	2	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels. It is expected to remain at this level through the period in the absence of significant sunspot regions in the western hemisphere.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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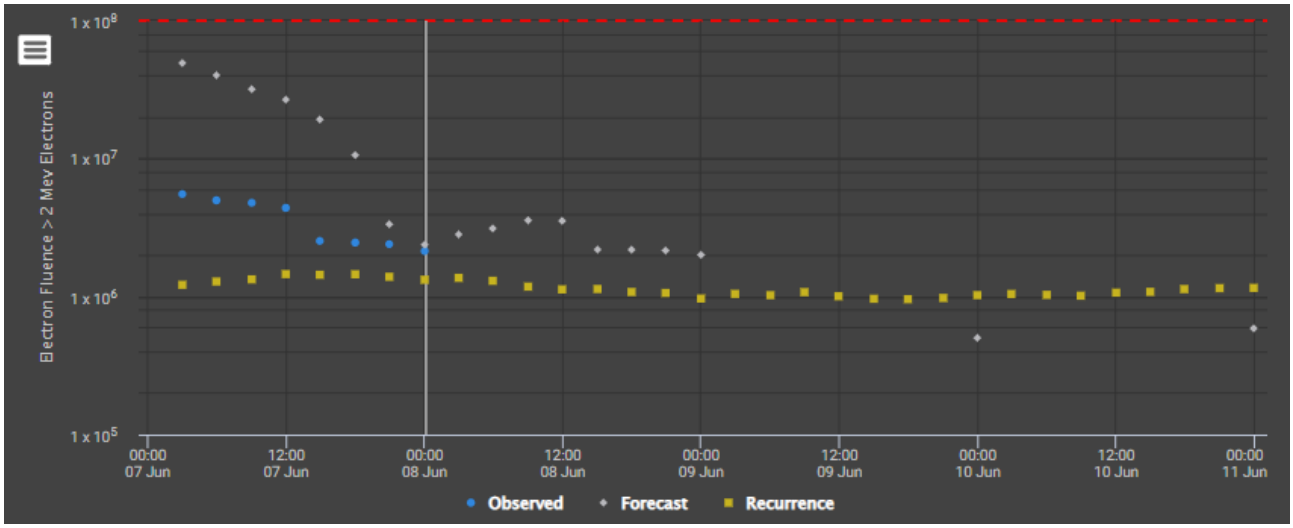
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) has been at mostly background levels through the last two days, after recent High levels. It is notable that the High levels dropped out sharply before the recent CME arrival. Now that those CME effects have waned, there is a slight possibility of a recovery in flux levels. However, the fact that the flux levels dropped out before the CME arrival suggests that flux levels may well stay at background or perhaps moderate levels until we get faster winds to charge the electrons. As there are no large coronal holes on the disc at present, charging is considered unlikely in this period.

Therefore, electron fluence is expected to stay below the Active threshold through to at least Day 4 (11 June), although a slight chance is maintained in case of a resumption of the previous High flux levels now that CME effects have waned. REFM is currently forecasting fluence to remain below the Active threshold, which is considered good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: REFM model suggesting fluence remaining below the Active (1e8 integrated pfu) threshold, which is considered good guidance.



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